

AMENDMENTS TO THE CLAIMS

Please delete the heading "CLAIMS" and insert the heading

WHAT IS CLAIMED IS:

This listing of claims will replace all prior versions and listings of claims in the application:

LISTING OF CLAIMS:

1-42. (Canceled)

43. (New) A protection system of a battery of a vehicle, the vehicle having a motor, an ignition system (MA) of the motor, a battery (BA) used by the ignition system (MA) in order to start the motor, an alternator (AL) actuated by the motor in order to recharge the battery (BA) and at least one electric load (CS) supplied by the battery (BA), the protection system comprising a device (1) for electrically disconnecting or connecting the battery (BA) with respect to the electric load (CS), the device (1) having

- switch means (20, 21, 22) connected in series between the battery (BA) and the electric load (CS) and capable of assuming a closed condition and an open condition, the switch means comprising a movable contact (21) and actuation means (20, 22) which can be actuated in order to displace the movable contact (21),

- a microprocessor control circuit (15), comprising means for measuring at least one electrical quantity (V_BATT, VB_AVG) being representative of a state of charge of the battery (BA), comparator means for operating a comparison between a measured value of the electrical quantity (V_BATT, VB_AVG) and a respective threshold value (VTH), control means capable of controlling the actuation means (20, 22) as a function of the comparison performed by the comparator means, characterized in that

- the control circuit (15) further comprises means for detecting ambient temperature (TEMP), means for detecting time of inactivity of the motor (E_OFF), means for calculating a mean value of voltage (VB_AVG) of the battery,

- the electrical quantity (V_BATT, VB_AVG) is the mean value of voltage of the battery (BA),
- the threshold value (VTH) is variable in function of the ambient temperature (TEMP) and the time of inactivity of the motor (E_OFF),
- the actuation means comprise a bistable electromagnetic arrangement (20, 21, 22) capable of passing from a first stable condition to a second stable condition following a pulse generated by the control means.

44. (New) The system according to claim 43, characterized in that the control circuit (15) comprises means for detecting the battery voltage (V_BATT).

45. (New) The system according to claim 44, characterized in that the control circuit (15) comprises means for cyclically detecting a difference of voltage at the ends of movable contact (21).

46. (New) The system according to claim 43, characterized in that the control circuit (15) comprises at least one of:

- means for acquiring or detecting a first signal being indicative of an active condition of the alternator (AL),
- means for acquiring or detecting a second signal being indicative of an active condition of the ignition system,
- means for measuring current distributed by the battery (BA), said means comprising in particular a Hall effect current sensor.

47. (New) The system according to claim 46, characterized in that the control circuit (15) is operative for causing in an automatic way closure of the switch means (20, 21, 22) in case a difference of voltage at ends of the movable contact (21) exceeds a predefined value for a certain number of successive detections and the first and the second signal are simultaneously present.

48. (New) The system according to claim 43, characterized in that the control circuit (15) comprises means for verifying the occurrence of a plurality of predetermined conditions and that the control circuit (15) is operative for causing in an automatic way the switch means

(20, 21, 22) to open in case the mean voltage (VB_AVG) is lower than the threshold value and, at the same time, said plurality of predetermined conditions occurs, said predetermined conditions being preferably selected in the group comprising the following: ignition system not active, in particular lack of insertion of an ignition key, alternator not active, vehicle's emergency lamps not active, lack of opening of vehicle's doors, lack of actuation of a vehicle's brake, lack of activation of vehicle's remote control devices.

49. (New) The system according to claim 43, characterized in that the control circuit (15) comprises means for measuring an internal resistance of the battery (BA), comprising in particular a low ohmic value resistor and an electronic switch, in particular a solid state relay.

50. (New) System according to claim 43, characterized in that the device (1) integrates, or is connected to, or comprises at least one of:

- a crash sensor,
- one or more fuses,
- a serial interface, in particular of CAN or LIN type, for connection of the control circuit (15) to an external electronic apparatus, the latter being in particular provided for
- receiving information detected by means of the control circuit (15) and/or
- sending information or configuration data to the control circuit (15).

51. (New) The system according to claim 43, characterized in that the bistable electromagnetic arrangement (20, 21, 22) comprises

- an electromagnet (20), having an inductor winding (20A) provided with a magnetic yoke (20B), the ends of the winding (20A) being electrically connected to the control circuit (15);
- a movable armature (20C), susceptible of being displaced in two opposite directions as a function of the polarity of excitation of the electromagnet (20);
- an elastic element (22), operative for pushing the armature (20C) in a first position;
- a permanent magnet (20D), susceptible of attracting the armature (20C) in order to maintain it in a second position against the action of the elastic element (22),

the movable contact (21) being preferably maintained in the closed position by means of the elastic element (22) and in the open position by means of the permanent magnet (22D), and being operatively associated to the armature (20C).

52. (New) The system according to claim 51, characterized in that the armature is configured as one of a core (20C) capable of linear movement and an anchor capable of angular movement.

53. (New) The system according to claim 51, characterized in that the movable contact (21) is supported by the armature (20C) with movement capability with respect to the latter.

54. (New) The system according to claim 43, characterized in that the device (1) comprises a casing realized by at least two parts (2, 3) mutually coupled in a sealed way, within which at least one of the bistable electromagnetic arrangement (20, 21, 22) and the control circuit (15) is housed.

55. (New) The system according to claim 43, characterized in that a covering element (5) is associated to a casing (2, 3) of the device, for two terminals (T1, T2) for connection of the device (1), the covering element (5) comprising a hooking part (6) and a closing part (7), mutually joined by means of an elastically deformable portion (8), acting as a hinge.

56. (New) The system according to claim 43, characterized in that the device (1) comprises manually actuated commutation means (12) being operatively associated to the control circuit (15) and provided for manually controlling, should the need arise, passage of the movable contact (21) from a respective first position to a respective second position, or vice versa.

57. (New) The system according to claim 43, characterized in that a vent device (14-14D) is associated to a casing (2, 3) of the device, operative for avoiding significant increases of pressure within the casing itself, the vent device (14-14D) comprising preferably a membrane (14B) of a material being permeable to air and impermeable to water and humidity.

58. (New) The system according to claim 54, characterized in that the control circuit (15) is at least partly mounted on a board having a plurality of through-holes (15A), some of said holes being designed for receiving ends of respective positioning pins (16) which rise from

the casing (2,3), and some others of said holes being designed for cooperating with fixing means (17) in order to fasten the board to the casing (2, 3).

59. (New) The system according to claim 43, characterized in that the device (1) comprises two connection terminals (T1, T2) connected to the control circuit through respective connection elements made of electrically conductive material (24, 25), which are at least in part wrapped by material constituting a casing (2, 3) of the device, each connection element (24, 25) being preferably obtained by a shaped metallic strap or small bar.

60. (New) The system according to claim 59, characterized in that each connection element (24, 25) comprises a first end portion (26) to which a respective terminal (T1, T2) is fixed, a second end portion (27) for connection to the control circuit (15), a median portion (28) that extends between the end portions (26, 27), an intermediate contact portion (29) capable of cooperating with the movable contact (21) the median portion (28) being preferably at least partially surrounded by material constituting a wall of the casing (2).

61. (New) The system according to claim 59, characterized in that at least a part (28A) of the median portion (28) has recesses or projections (28B) defining a labyrinth apt for cooperating with said material in order to eliminate possible water and humidity infiltrations towards the inside of the casing (2, 3), a thermoplastic material being preferably molded with or over said part (28A), which is in turn wrapped by material constituting said wall of the casing (2, 3).

62. The system according to claim 43, characterized in that the device (1) comprises two connection terminals (T1, T2), to at least one of which there is electrically associated a conductor (30) having at least a portion protruding outside a casing (2) of the device, to realize a jump start contact, i.e., a fixing point for a clamp of an electric cable for connection to an auxiliary starting system of the vehicle.

63. (New) The system according to claim 62, characterized in that said portion passes through an aperture (6B) of a movable covering element (5) for two connecting terminals (T1, T2) of the device (1), said portion being accessible when the movable covering element (5) is in a respective open position.

64. (New) A device (1) for electrically connecting and/or disconnecting a battery (BA) of a vehicle with respect to an electric load (CS) of the vehicle, the device (1) having

- a casing (2,3),
- two terminals (T1, T2) for connecting the device (1) in series between the battery (BA) and the electric load (CS),
- switch means (20, 21, 22) operatively interposed between the two terminals (T1, T2) and capable of assuming a closed condition and an open condition, the switch means comprising a movable contact (21) and actuation means (20, 22) which can be actuated for displacing the movable contact (21),
- a microprocessor control circuit (15), comprising means for measuring at least one electrical quantity (V_BATT, VB_AVG) being representative of a state of charge of the battery (BA), comparator means for performing a comparison between the measured value of the electrical quantity (V_BATT, VB_AVG) and a respective threshold value (VTH), control means capable of controlling the actuation means (20, 22) in function of the comparison operated by the comparator means,

characterized in that a conductor (30) is associated to the terminal (T1) which is provided for being connected to the positive polarity of the battery (BA), the conductor (30) having at least one portion protruding outside the casing (2, 3), to realize a jump start contact, i.e., a fixing point for a clamp of an electric cable for the connection to an auxiliary starting system of the vehicle.

65. (New) The device according to claim 64, characterized in that a covering element (5) is associated to the casing (2, 3) for the two terminals (T1, T2) and the conductor (30), the covering element (5) comprising a hooking part (6) and a closing part (7), mutually joined by means of an elastically deformable portion (8), acting as a hinge, said portion of the conductor (30) passing preferably in a passage (6B) of the covering element (5) for being directly accessible when the latter is in a respective open position.

66. (New) A device (1) for electrically connecting and/or disconnecting a battery (BA) of a vehicle with respect to an electric load (CS) of the vehicle, the device (1) having

- a casing (2,3) made of at least two parts (2, 3) mutually coupled in a sealed way,

- two terminals (T1, T2) for connecting the device in series between the battery (BA) and the electric load (CS),
- switch means (20, 21, 22) operatively interposed between the two terminals (T1, T2) and capable of assuming a closed condition and an open condition, the switch means comprising a movable contact (21) and actuation means (20, 22) which can be actuated in order to displace the movable contact (21),
- a microprocessor control circuit (15), comprising means for measuring at least one electrical quantity (V_BATT, VB_AVG) representative of a state of charge of the battery (BA), comparator means for performing a comparison between the measured value of the electrical quantity (V_BATT, VB_AVG) and a respective threshold value (VTH), control means capable of controlling the actuation means (20, 22) in function of the comparison operated by the comparator means, characterized in that a vent device (14-14D) is associated to the casing (2, 3), operative for avoiding significant increases of pressure within the casing itself.

67. (New) The device according to claim 66, characterized in that the vent device (14-14D) comprises a membrane (14B) made of a material which is permeable to air and impermeable to water and humidity.

68. (New) A device (1) for electrically connecting and/or disconnecting a battery (BA) of a vehicle with respect to an electric load (CS) of the vehicle, the device (1) having

- a sealed casing (2,3),
- two terminals (T1, T2) for connecting the device in series between the battery (BA) and the electric load (CS),
- switch means (20, 21, 22) operatively interposed between the two terminals (T1, T2) and capable of assuming a closed condition and an open condition, the switch means comprising a movable contact (21) and actuation means (20, 22) which can be actuated in order to displace the movable contact (21),
- a microprocessor control circuit (15), comprising means for measuring at least one electrical quantity (V_BATT, VB_AVG) representative of a state of charge of the battery (BA), comparator means for performing a comparison between the measured value of the

electrical quantity (V_BATT, VB_AVG) and a respective threshold value (VTH), control means capable of controlling the actuation means (20, 22) in function of the comparison operated by the comparator means,

characterized in that the terminals (T1, T2) are connected to the control circuit (15) by means of respective connection elements made of conductive material (24, 25), wherein at least a part (28) of the connection elements (24, 25) that it is surrounded by material constituting the casing (2,3) has recesses and/or projections (28B) defining a labyrinth aimed at eliminating possible water and humidity infiltrations towards the inside of the casing (2, 3).

69. (New) The device according to claim 68, characterized in that a thermoplastic material is molded with or over said part (28A), which is in turn wrapped by material constituting the casing (2, 3).

70. (New) System according to claim 68, characterized in that each connection element (24, 25) comprises

- a first end portion (26) to which a respective terminal (T1, T2) is fixed,
- a second end portion (27) for the connection to the control circuit (15),
- a median portion (28) that extends between the end portions (26, 27),
- an intermediate contact portion (29) capable of cooperating with the movable contact (21):

71. (New) A protection system of a battery of a vehicle, the vehicle having a motor, an ignition system (MA) of the motor, a battery (BA) used by the ignition system (MA) in order to start the motor, an alternator (AL) actuated by the motor in order to recharge the battery (BA) and at least one electric load (CS) supplied by the battery (BA), the protection system comprising a device (1) for electrically disconnecting or connecting the battery (BA) with respect to the electric load (CS), the device (1) having

- switch means (20, 21, 22) connected in series between the battery (BA) and the electric load (CS) and capable of assuming a closed condition and an open condition, the switch means comprising a movable contact (21) and actuation means (20, 22) which can be actuated in order to displace the movable contact (21),

- a microprocessor control circuit (15), comprising means for measuring at least one electrical quantity (V_BATT, VB_AVG) being representative of a state of charge of the battery (BA), comparator means for operating a comparison between the measured value of the electrical quantity (V_BATT, VB_AVG) and a respective threshold value (VTH), control means capable of controlling the actuation means (20, 22) as a function of the comparison performed by the comparator means, the control circuit (15) further comprising means for detecting a first signal being indicative of an active condition of the alternator (AL) and means for detecting a second signal being indicative of an active condition of the ignition system,

wherein the control circuit (15) is operative for causing in an automatic way closure of the switch means (20, 21, 22) in case difference of voltage at ends of the movable contact (21) exceeds a predefined value for a certain number of successive detections and the first and the second signal are simultaneously present.